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APPLICATION NO.	FILING DATE	FIRST NAMED INVENTOR	ATTORNEY DOCKET NO.	CONFIRMATION NO.
09/932,896	08/20/2001	Michael Leon Kazar	SPIN-3	8068

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EXAMINER

THOMAS, SHANE M

ART UNIT	PAPER NUMBER
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2186

2

DATE MAILED: 07/07/2004

Please find below and/or attached an Office communication concerning this application or proceeding.

Office Action Summary

Application No.

09/932,896

Applicant(s)

KAZAR, MICHAEL LEON

Examiner

Shane M Thomas

Art Unit

2186

-- The MAILING DATE of this communication appears on the cover sheet with the correspondence address --

Period for Reply

A SHORTENED STATUTORY PERIOD FOR REPLY IS SET TO EXPIRE 3 MONTH(S) FROM THE MAILING DATE OF THIS COMMUNICATION.

- Extensions of time may be available under the provisions of 37 CFR 1.136(a). In no event, however, may a reply be timely filed after SIX (6) MONTHS from the mailing date of this communication.
- If the period for reply specified above is less than thirty (30) days, a reply within the statutory minimum of thirty (30) days will be considered timely.
- If NO period for reply is specified above, the maximum statutory period will apply and will expire SIX (6) MONTHS from the mailing date of this communication.
- Failure to reply within the set or extended period for reply will, by statute, cause the application to become ABANDONED (35 U.S.C. § 133). Any reply received by the Office later than three months after the mailing date of this communication, even if timely filed, may reduce any earned patent term adjustment. See 37 CFR 1.704(b).

Status

- 1) ☐ Responsive to communication(s) filed on ____.
- 2a) ☐ This action is **FINAL**. 2b) ☒ This action is non-final.
- 3) ☐ Since this application is in condition for allowance except for formal matters, prosecution as to the merits is closed in accordance with the practice under *Ex parte Quayle*, 1935 C.D. 11, 453 O.G. 213.

Disposition of Claims

- 4) ☒ Claim(s) 1-16 is/are pending in the application.
- 4a) Of the above claim(s) ____ is/are withdrawn from consideration.
- 5) ☐ Claim(s) ____ is/are allowed.
- 6) ☒ Claim(s) 1-4 and 7-9 is/are rejected.
- 7) ☒ Claim(s) 5,6 and 10-16 is/are objected to.
- 8) ☐ Claim(s) ____ are subject to restriction and/or election requirement.

Application Papers

- 9) ☒ The specification is objected to by the Examiner.
- 10) ☒ The drawing(s) filed on 20 August 2001 is/are: a) ☐ accepted or b) ☒ objected to by the Examiner.
Applicant may not request that any objection to the drawing(s) be held in abeyance. See 37 CFR 1.85(a).
Replacement drawing sheet(s) including the correction is required if the drawing(s) is objected to. See 37 CFR 1.121(d).
- 11) ☐ The oath or declaration is objected to by the Examiner. Note the attached Office Action or form PTO-152.

Priority under 35 U.S.C. § 119

- 12) ☐ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).
- a) ☐ All b) ☐ Some * c) ☐ None of:
1. ☐ Certified copies of the priority documents have been received.
2. ☐ Certified copies of the priority documents have been received in Application No. ____.
3. ☐ Copies of the certified copies of the priority documents have been received in this National Stage application from the International Bureau (PCT Rule 17.2(a)).

* See the attached detailed Office action for a list of the certified copies not received.

Attachment(s)

- 1) ☒ Notice of References Cited (PTO-892)
- 2) ☐ Notice of Draftsperson's Patent Drawing Review (PTO-948)
- 3) ☐ Information Disclosure Statement(s) (PTO-1449 or PTO/SB/08)
Paper No(s)/Mail Date ____.
- 4) ☐ Interview Summary (PTO-413)
Paper No(s)/Mail Date ____.
- 5) ☐ Notice of Informal Patent Application (PTO-152).
- 6) ☐ Other: ____.

DETAILED ACTION

Drawings

The drawings are objected to as failing to comply with 37 CFR 1.84(p)(5) because they do not include the following reference character(s) mentioned in the description:

Element 14, described in reference to figure 1 on page 5, line 4-8 of the Applicant's disclosure, does not appear in figure 1.

The drawings are further objected to as failing to comply with 37 CFR 1.84(p)(4) because reference character "18" has been used to designate both a *single* disk block (as shown comprised in --Disk₁-- of figure 1) and a *plurality* of disk blocks (as shown comprised in --Disk₂--).

The drawings are further objected to because due to the --cross-hatching-- of servers 12 [that did not win arbitration], the text of --Server 2-- and --Server 3-- is not clearly discernable.

Corrected drawing sheets are required in reply to the Office action to avoid abandonment of the application. Any amended replacement drawing sheet should include all of the figures appearing on the immediate prior version of the sheet, even if only one figure is being amended. The replacement sheet(s) should be labeled "Replacement Sheet" in the page header (as per 37 CFR 1.84(c)) so as not to obstruct any portion of the drawing figures. If the changes are not accepted by the examiner, the applicant will be notified and informed of any required corrective action in the next Office action. The objection to the drawings will not be held in abeyance.

Specification

The disclosure is objected to because of the following informalities:

Page 7, line 15-19, of the Applicant's disclosure states, --Note that the box labeled "fibrechannel switched network" is not an arbiter--. Figure 2 does not comprise an element containing such a label. Appropriate correction is required.

Claim Objections

Claim 1 is objected to because of the following informalities:

As per claim 1, line 9, it is unclear whether the term --a set of disks-- is referring to the --set-- of D disks, claimed in line 2, or an arbitrary set of disks, separate from the D disks. Page 5, lines 16-22, of the disclosure states that a voting protocol is used to determine which server has access to the disks 14 - the same set of disks comprising reserved disk blocks for each server to use during arbitration. Thus the Examiner recommends amending claim 1 to reflect the association between the term --a set of disks-- and the --set-- of D disks. Appropriate correction is required.

Claim Rejections - 35 USC § 102

The following is a quotation of the appropriate paragraphs of 35 U.S.C. 102 that form the basis for the rejections under this section made in this Office action:

A person shall be entitled to a patent unless –

(e) the invention was described in (1) an application for patent, published under section 122(b), by another filed in the United States before the invention by the applicant for patent or (2) a patent granted on an application for patent by another filed in the United States before the invention by the applicant for patent, except that an international application filed under the treaty defined in section 351(a) shall have the effects for purposes of this subsection of an application filed in the United States only if the international application designated the United States and was published under Article 21(2) of such treaty in the English language.

Claims 2-4 and 7 are rejected under 35 U.S.C. 102(e) as being anticipated by Reuter et al (U.S. Patent No. 6,463,532).

As per claims 2 and 7,

Line 2 (claim 2): *N servers, where $N \geq 2$ and is an integer;*

Reuter shows a portion of a data storage system in figure 2, which comprises [at least] four --servers-- 202-208 in the present illustrated embodiment shown.

Lines 3-5 (claim 2): *D disks, where $D \geq 2$ and is an integer, each server in communication with each disk, each disk having a reserved disk block for each of the N servers;*

Reuter states in column 7, lines 21-24, that a --reserved block-- associated with each --server-- (202-208) is contained on each consensus disk.

Lines 6-7 (claim 2): *a disk arbitration mechanism where each of the of the N servers writes its state in its own associated disk block in each disk*

Reuter teaches in column 7, lines 54-55, that each --server-- writes its current information (--state--) to its own disk block on each consensus disk.

Lines 8-10 (claim 2): *reads all the other server's disk blocks in each disk in order to determine which server had access to, and use of and control of the disks at a given time.*

Art Unit: 2186

Reuter teaches in column 4, lines 7-19, that the read operation (--server-- reading the disk block of every other --server-- as stated in column 3, lines 36-39) detects if another --server-- is attempting to commit a command. In order to commit a command, Reuter teaches in column 2, line 61 - column 3, line 46, that in order to write data to a shared disk, a --server-- must first exclusively access the disk in which to write the --server's state--. Thus it can be seen when writing occurs, only one --server-- has privilege to the disk. Thus by reading the disk blocks of the other --servers-- a given --server-- can determine which other --server-- has access to and use and control (via mutual exclusion) of the disks at a given time (the time at which the other server writes its --state-- into its own disk block of each disk since no other --server-- could have accessed the disks at the time a given --server-- was writing to the disks).

Regarding claim 7, the rejection of lines 2-4 follows the rejection of claim 2, lines 2-7, and the rejection of lines 5-7 follows the rejection of claim 2, lines 8-10.

As per claim 3,

Wherein each server has an index

Reuter shows each --server-- 202-208 as having an --index-- (ID 214-220) in figure 2.

As per claim 4,

Wherein the disk arbitration mechanism causes each server at first predetermined times to read all of the disk blocks, and write its own disk block to determine which server has access to, and use and control of the disks at a given time.

The Examiner is considering during execution of --Round 1-- (figure 4) as the *first* predetermined time when the disk blocks of other --servers-- are read by a given --server-- (step 312) and the --server-- writes its own disk block (step 308). As stated above in claims 2 and 7's

Art Unit: 2186

rejection, in order to write its own disk block, a given --server-- must have exclusive access to the disk that that comprises the --server's-- disk block to be written. Thus it can be seen that

Claim Rejections - 35 USC § 103

The following is a quotation of 35 U.S.C. 103(a) which forms the basis for all obviousness rejections set forth in this Office action:

(a) A patent may not be obtained though the invention is not identically disclosed or described as set forth in section 102 of this title, if the differences between the subject matter sought to be patented and the prior art are such that the subject matter as a whole would have been obvious at the time the invention was made to a person having ordinary skill in the art to which said subject matter pertains. Patentability shall not be negated by the manner in which the invention was made.

Claims 1, 8, and 9 are rejected under 35 U.S.C. 103(a) as being unpatentable over Reuter et al (U.S. Patent No. 6,463,532) in further view of Reuter et al. (U.S. Patent No. 6,226,717). Herein, U.S. Patent No. 6,463,532 shall be referenced as **Reuter₁** and U.S. Patent No. 6,226,717 shall be referenced as **Reuter₂**.

As per claim 1,

Line 2: *N servers, where $N \geq 2$ and is an integer;*

Reuter₁ shows a portion of a data storage system in figure 2, which comprises [at least] four --servers-- 202-208 in the present illustrated embodiment shown.

Lines 3-5: *D disks, where $D \geq 2$ and is an integer, each server in communication with each disk, each disk having a reserved disk block for each of the N servers;*

Figure 2 shows *two* storage locations 222 and 224 which Reuter₁ calls --shared storage locations-- (column 6, lines 11-15); he defines a --shared storage location-- as comprising a magnetic disk drive (column 6, lines 19-21). Thus it can be seen that $D=2$. Reuter₁ teaches in

Art Unit: 2186

column 6, lines 4-16, that --servers-- can communicate with either of the --shared storage locations-- 222-224. The Examiner is considering the critical storage blocks (CS1 and CS2) (column 6, lines 21-27) associated with each --shared storage location-- (magnetic disk) to be a *reserved disk block*. Further *each* of the --servers-- can access the --reserved disk blocks-- (CS1 and CS2).

Lines 6-9: *a disk arbitration mechanism that uses a timestamp-based voting algorithm over the disk blocks associated with the servers to exchange votes for a primary server to arbitrate access of the servers to a set of disks.*

The Examiner is considering the *disk arbitration* mechanism to be the mutual exclusion process that is performed before an access of one of the --shared storage locations-- 222-224 can be made since only one --server-- wins the arbitration to access disk 222 or 224. The Examiner is considering the --voting-- algorithm to be the --servers-- vying for exclusive access to the shared storage locations with the *timestamp* being the counter (fields 226 and 228) that are used when attempting to gain exclusive access by the --servers-- 202-208. The counter (timestamp) is updated each time a --server--reserve a disk block.

Reuter₁ does not specifically state how a --server-- --votes-- using the disk blocks (242 and 244). Reuter₂ (the prior co-pending patent application, now patent) explains the --voting-- algorithm in greater detail. It would have been obvious to one having ordinary skill in the art at the time the invention was made to have combined the data storage system of Reuter₁ with the mutual exclusion teaching of Reuter₂ in order to have utilized a locking algorithm for exclusive access to a shared storage location that could have detected a crash condition that is causing a

Art Unit: 2186

--server-- to refuse to release a lock on the shared resource (column 4, lines 63-65, of Reuter₂).

Further motivation for this combination can be found in Reuter₁ (column 6, line 64 - column 7, line 7).

Reuter₂ shows in figure 3 a --voting-- algorithm that is performed over the disk blocks 242 and 244 (CS1 and CS2). The Examiner is considering the --voting-- to comprise a --server-- accessing and writing its index in CS1 as shown in step 308. A --server-- loses the --vote-- if in step 308 the --server's-- index is no longer written in data block CS1. Thus is due to another --server-- winning the --vote-- and capturing the lock for the shared storage location (column 8, lines 38-50, of Reuter₂). The --server-- that wins the --vote-- and thus can write to shared storage location (222 or 244) is being considered as being the --primary server--. Thus is can be seen that the disk arbitration mechanism of modified Reuter₁ arbitrates access of the --servers-- 202-208 to the set of disks (shared storage locations 222-224).

In other words, the Examiner is interpreting the claims language of lines 6-9 of claim 1 as: a disk arbitration mechanism that uses a timestamp-based voting algorithm *to arbitrate access of the servers to the set of disks*. The timestamp-based voting algorithm uses the disk blocks associated with the servers to exchange votes for a primary server. This primary server is designated as such since it is the only server at that point in time to have exclusive access to the shared storage location (222 or 224).

As per claim 8,

Wherein the reading step includes the step of performing a voting protocol to determine which server has access to, and use and control of the disks at a given time.

Art Unit: 2186

The rejection follow the rejection of claim 1, lines 6-9 above, which discusses how the mutual exclusion algorithm requires --servers-- to --vote-- for exclusive access a disk in order to write to the --server's-- disk block.

As per claim 9,

Including after the reading step, there are steps of determining which server becomes a winning server and has access to, and use and control of the disk at a given time; and accessing the disk exclusively by the winning server.

Reuter states in column 8, lines 20-25, that Round 2 (figure 5) follows Round 1 (figure 4). Thus it can be seen that the writing of current information (--server's state--) to each of a --server's-- disk blocks on each disk (step 406 of figure 5) occurs *after the reading step* of Round 1 (step 312 of figure 4). As stated above, in order to write the --server's-- disk block exclusive access by means of the voting algorithm must be granted to the requesting server before the writing can occur. The Examiner is considering the --server-- that wins the voting process to be the --winning server-- (in the case where more than one server is trying to write its --state-- to the disks. That winning server can then access the disk exclusively.

Allowable Subject Matter

Claim 5,6, and 10-16 are objected to as being dependent upon a rejected base claim, but would be allowable if rewritten in independent form including all of the limitations of the base claim and any intervening claims.

The following is a statement of reasons for the indication of allowable subject matter:

Art Unit: 2186

As per claim 5, neither Reuter nor the prior art of record teach in column 7, lines 30-33, that the current state of a --server-- that is written in the disk blocks of the shared disks, can also be stored [in a memory] in the --server-- itself. However, Reuter, as shown in figure 3, does not maintain a field for maintaining the last time at which each --server's-- state changed.

As per claim 10, neither Reuter nor the prior art of record teach, or suggest motivation for, invalidating the caches of the server that wins arbitration of the disks.

Claims 6 and 11-16 are dependent on allowable claims 5 and 10, respectively.

Conclusion

The prior art made of record and not relied upon is considered pertinent to applicant's disclosure.

Gamache et al. (U.S. Patent Application Publication No. 2002/0161889) teaches arbitrating by a group of servers for exclusive ownership of replica members (cluster of hard drives).

Naeimi et al. (U.S. Patent No. 6,363,416) teaches a master server election process.

Nishanov et al. (U.S. Patent No. 6,662,219) teaches subgroups (servers) arbitrating for possession of a quorum resource.

Goyal et al. (IBM Technical Disclosure Bulletin vol. 27 no. 8) teaches an election algorithm in a ring network for choosing a master server when a previous master server fails.

Any inquiry concerning this communication or earlier communications from the examiner should be directed to Shane M Thomas whose telephone number is (703) 605-0725.

The examiner can normally be reached on M-F 8:30 - 5:30.


Art Unit: 2186

If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, Matt M Kim can be reached on (703) 305-3821. The fax phone number for the organization where this application or proceeding is assigned is 703-872-9306.

Information regarding the status of an application may be obtained from the Patent Application Information Retrieval (PAIR) system. Status information for published applications may be obtained from either Private PAIR or Public PAIR. Status information for unpublished applications is available through Private PAIR only. For more information about the PAIR system, see <http://pair-direct.uspto.gov>. Should you have questions on access to the Private PAIR system, contact the Electronic Business Center (EBC) at 866-217-9197 (toll-free).



Shane M. Thomas



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